

PERMISSIBLE MINING-LOADING EQUIPMENT

BY H. B. BRUNOT

• • • • • Information Circular 7736



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SUMMARY

On April 26, 1949, the Bureau first approved a machine designed to replace the cycle of cutting, blasting, and loading coal by a single operation. This machine took the coal directly from the solid face and delivered it to transportation equipment. By January 1, 1955, 30 approvals for designs of machines of this type had been granted by the Bureau.

In the main, this paper describes briefly the action of the various designs approved as permissible. In addition, the approval number, the date of approval, the voltage of the power supply, the number and character of the explosion-proof accessory parts, the size of the trailing cable, and the overcurrent protection at the outby end of the trailing cable are given for each design.

Since no similar information has been published by the Bureau, it is hoped the material in this paper will be valuable in giving the mining public an organized look at the various machines of this nature that have been approved as permissible by the Bureau.

INTRODUCTION

The Bureau of Mines investigates and approves equipment as permissible for use in gassy and dusty mines only when it meets certain minimum standards of safety. These standards are designated as schedules; they establish certain minimum requirements of safety and give details of inspections and tests adopted to determine whether the standards have been met and list the charges for such investigations by the Bureau. Any responsible party can submit his equipment for investigation in accordance with the conditions outlined in the schedules. After the effective date of Public Law 552, all new electric equipment for operation in the face regions of gassy mines employing more than 14 persons underground is required by Federal law to be approved by the Bureau as permissible. Before the passage of this law, the use of such equipment was voluntary except where required by State law.

The first electric-motor-powered machines tested by the Bureau of Mines for safety in gassy and dusty coal mines were shortwall coal-cutting machines, and the first machine approved as permissible was a shortwall coal-cutting machine. This approval was dated September 30, 1914, and was granted under the provisions of Schedule 2. Since approval of Schedule 2 by the Secretary of the Interior on October 26, 1911, several revisions of the requirements have been made. Those revisions in effect when the machines described in this publication were approved were contained in Schedule 2E.

Machines for operation at the coal face have been steadily improved and the varieties of designs have greatly increased during the years. Thus, various types of coal-cutting machines, coal-loading machines, conveyors, etc., have been developed, and their designs have been investigated and approved as permissible by the Bureau. The latest developments have produced machines designed to replace the cycle of cutting, blasting, and loading. They take the coal directly from the solid face and deliver it to conveyors, shuttle cars, or other transportation equipment in one operation.

Thirty designs of these so-called continuous miners have been approved as permissible by the Bureau. This paper describes briefly each design approved by the Bureau. Descriptions of the detail features of the various explosion-proof parts used on the various machines will not, in general, be given.

APPROVED MACHINES BUILT BY JOY MANUFACTURING CO.

General Description

The Joy Manufacturing Co. continuous mining machines are mining and loading machines designed to take coal from the solid face and deliver it to a room-conveyor, shuttle car or other transportation equipment without undercutting, drilling, and shooting down the coal. In operation, the ripper head (see a, figs. 1, 2, 3, and 4) is sumped into the coal face, either at the top or bottom, depending on the design of head, and then swung vertically down or up, ripping the coal from the solid as it moves. The scrolls (see b, fig. 1) gather the loose coal to the center where it is picked up by the front conveyor of the machine. Two types of ripper heads have been used; the type shown in figures 3 and 4 has a number of parallel cutter chains carrying bits to rip the coal from the face. The type shown by figures 1 and 2 has a cutter chain at each side, with a rotating drum between them driven by the chains. Both the chains and the rotating drum carry bits to dislodge the coal from the face. The machines in figures 1, 2, and 4 are caterpillar-mounted for tramping. Caterpillar tracks are not used with the type 2WM machine shown in figure 3, the so-called Walking Miner, so that the machine will be low for thin-seam work. This machine is moved by a large base that supports the entire machine and four lift jacks that raise the machine for positioning of the base.

Four general types of permissible continuous mining machines have been built by the Joy Manufacturing Co. A number of modifications of the various general types have been approved. Aside from the type 2WM machine, both direct-current and alternating-current designs have been covered. Only the direct-current 2WM has been approved by the Bureau. The type 3JCM (fig. 1) is for low seams; the type 4JCM (fig. 2), is for high seams; and the type 2WM (fig. 3) is for very low seams. The type 1CM (fig. 4) is slightly smaller than the type 4JCM but is designed for greater production.

Several electrical parts can be seen in the four figures. In some instances the same design of accessories is used on the different types, and in other instances the corresponding parts are of different design.

In figure 1 c is 1 of the 2 motors driving the ripper head, a headlight is at d, 1 of the 2 traction motors is at e, the hydraulic pump motor is at f, and the 2 rear conveyor motors are at g. In figure 2 b is 1 of the 2 motors driving the ripper head, c is the controller and resistance compartment, d is 1 of the 2 traction motors, e shows the 2 headlights, and the 2 rear conveyor motors are at f. In figure 3 b is the controller on the machine, c is a headlight, d is a headlight resistance box, e shows the two conveyor motors, and f is the skid-mounted remote-control compartment. In figure 4 b is a main motor, c is a traction motor, d is a rear conveyor motor, e is the master switch, and f shows two headlights.

Details relating to the various designs, for which 14 approvals have been granted, follow:

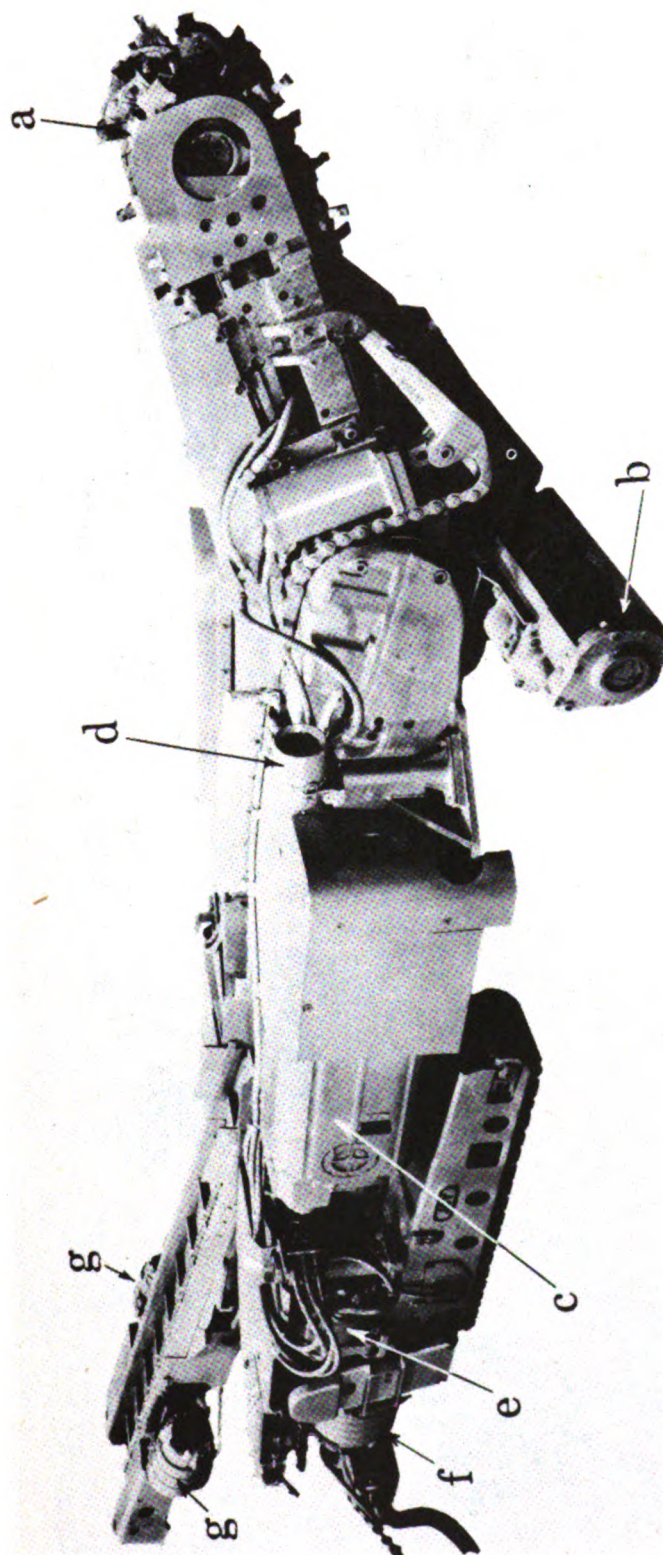


Figure 1. - Joy type 3JCM machine.

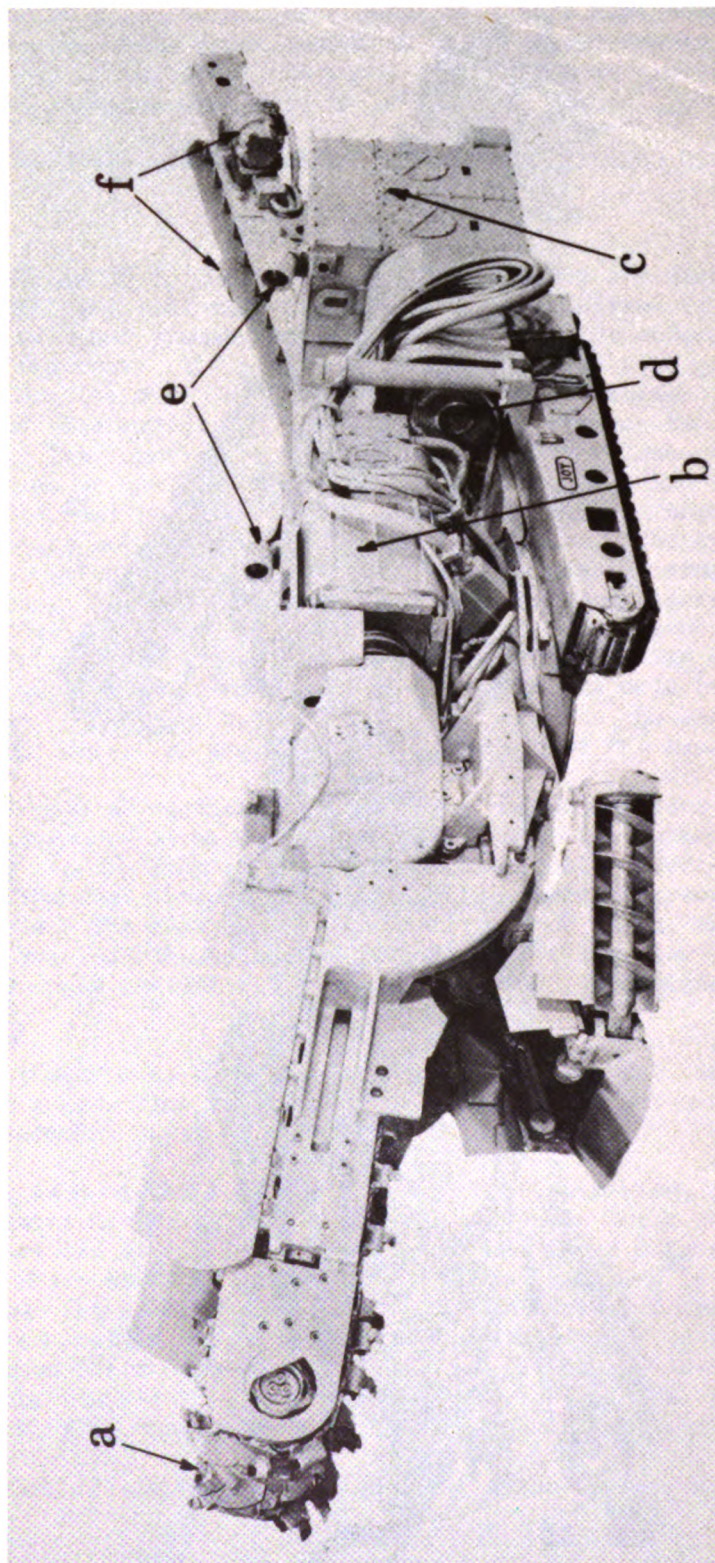


Figure 2. - Joy type 4JCM machine.

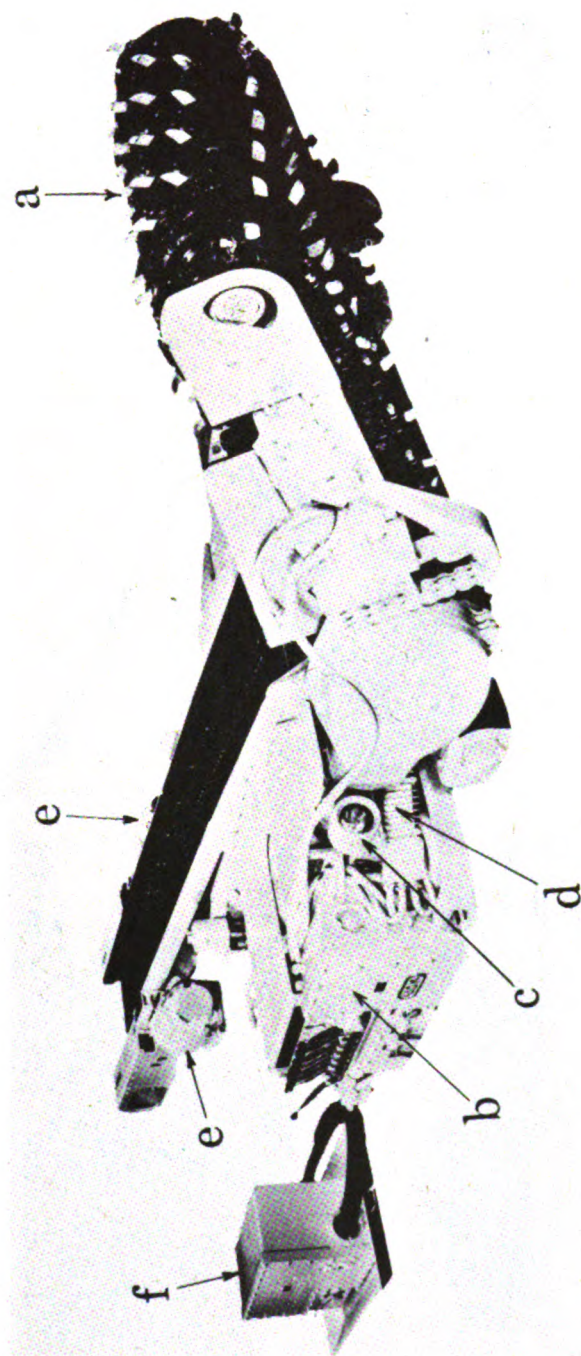


Figure 3. - Joy type 2WM machine.

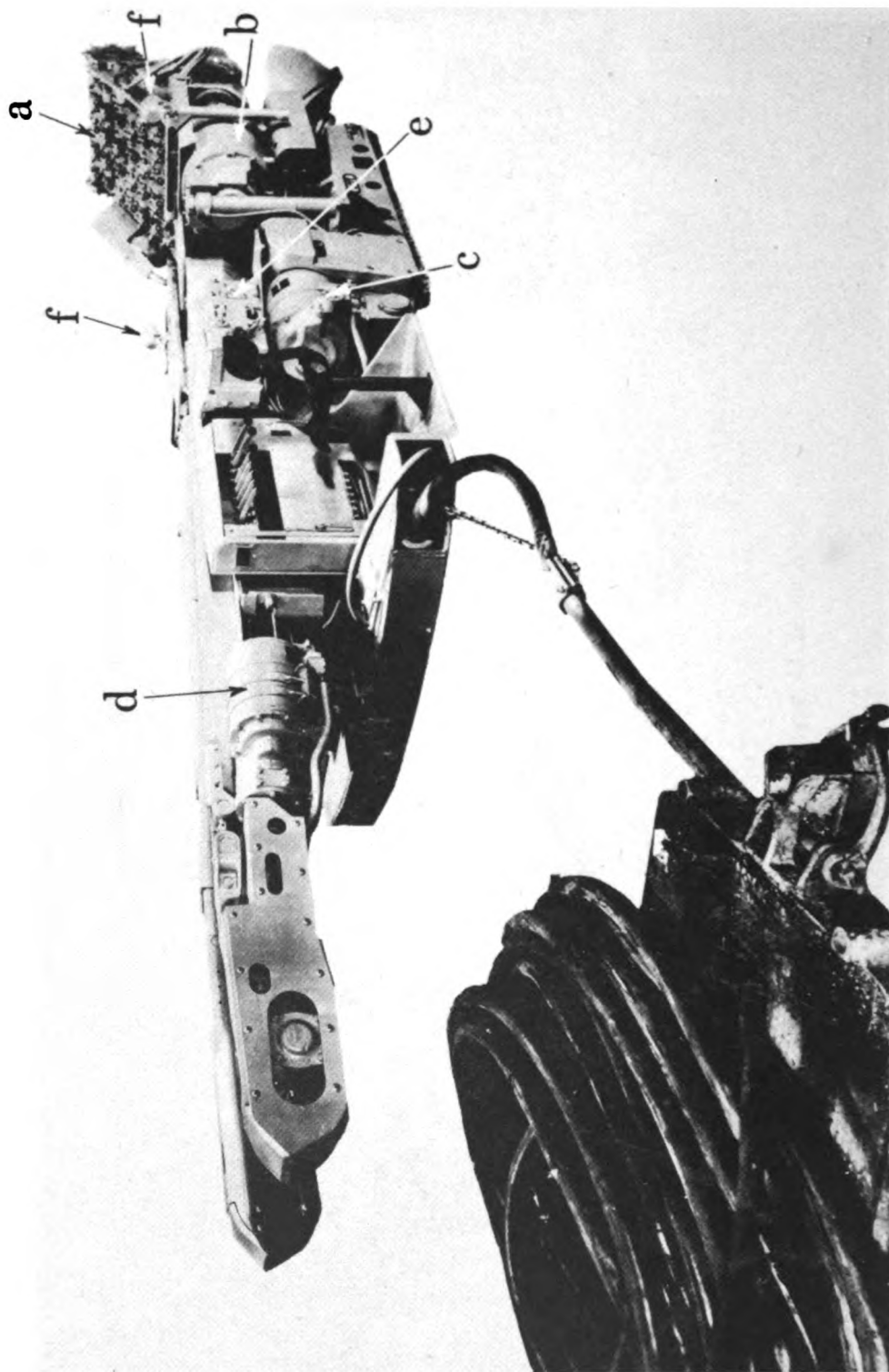


Figure 4. - Joy type ICM machine.

Type 3JCM-2 D.-C. Continuous Miner

Approvals 2-666 and 2-666A, covering the design of the type 3JCM-2 continuous miner, were issued to the Joy Manufacturing Co. on April 26, 1949. The approvals apply to machines for operation from 250- and 500-volt, direct-current supplies.

Seventeen parts on this machine, as originally approved, were required to be explosion-proof: (1) A controller and resistance compartment; (2) two 65-horsepower motors; (3) three 7-1/2-horsepower motors; (4) two 5-horsepower motors; (5) 2 connection boxes, 1 on each 65-horsepower motor; (6) a master switch; (7) 2 headlights; (8) a headlight switch compartment; (9) 2 headlight resistance compartments; and (10) a trailing-cable connection box. In addition to the parts listed, several connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected from mechanical injury by conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machines through 300 feet of 3-conductor, flame-resistant cable, No. 2/0 for 250 volts and No. 2 for 500 volts. One conductor is used for a frame ground connection. The cable was protected at the outby end by a circuit breaker set at 1,500 to 1,800 amperes for 250 volts and 1,000 to 1,200 amperes for 500 volts. An insulated mechanical strain clamp prevents strains on the terminal connections at the machines.

The type 3JCM-2A continuous miner was added by extensions of approvals under date of May 5, 1949. The principal differences from the 3JCM-2 machine are that a changed trailing-cable connection box incorporating the headlight switch is used, and the separate headlight switch compartment is eliminated. Also, the size of the trailing cable is increased to No. 4/0 for 250-volt and No. 2/0 for 500-volt machines.

Type 4JCM-1 D.-C. Continuous Miner

Approvals 2-675 and 2-675A, covering the design of the type 4JCM-1 continuous miner, were issued to the Joy Manufacturing Co. on July 1, 1949. The approvals apply to machines for operation from 250- and 500-volt, direct-current supplies.

Sixteen parts on this machine, as originally approved, were required to be explosion-proof: (1) A controller and resistance compartment; (2) two 65-horsepower motors; (3) three 7-1/2-horsepower motors; (4) two 5-horsepower motors; (5) 2 connection boxes, 1 each of the 65-horsepower motors; (6) a master switch; (7) 2 headlights; (8) a headlight switch compartment; and (9) 2 headlight resistance compartments. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 300 feet of 3-conductor, flame-resistant cable, No. 2/0 for 250 volts and No. 2 for 500 volts. One conductor is used for a frame-ground connection. The cable is protected at the outby end by a circuit breaker set at 1,500 to 1,800 amperes for 250 volts and 1,000 to 1,200 amperes for

500 volts. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Type 4JCM-1A D.-C. Continuous Miner

Approvals 2-734 and 2-734A, covering the design of the 4JCM-1A continuous miner, were issued to the Joy Manufacturing Co. on May 22, 1950. The approvals apply to machines for operation from 250- and 500-volt, direct-current supplies.

Sixteen parts on this machine were required to be explosion-proof:

(1) A controller and resistance compartment; (2) two 65-horsepower motors; (3) three 7-1/2-horsepower motors; (4) two 5-horsepower motors; (5) 2 connection boxes, 1 on each of the 65-horsepower motors; (6) a master switch; (7) 2 headlights; (8) a headlight switch compartment; and (9) 2 headlight resistance compartments. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 300 feet of 3-conductor, flame-resistant cable, No. 4/0 for 250 volts and No. 2/0 for 500 volts. One conductor is used as a frame ground connection. The cable is protected at the outby end by a circuit breaker set at 1,500 to 1,800 amperes for 250 volts and 1,000 to 1,200 amperes for 500 volts. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Types 4JCM-1A and 4JCM-2 A.-C. Continuous Miners

Approvals 2-739 and 2-739A, covering the designs of the 4JCM-1A and 4JCM-2 continuous miners, were issued to the Joy Manufacturing Co. on June 12, 1950. The approvals apply to 4JCM-1A machines for operation from 220-, 440-, 380-, and 400-volt, alternating-current supplies. The 4JCM-2 machine was covered for operation from a 220-volt supply. The approval was extended under date of September 1, 1950, to cover machines for operation from 500-volt supplies.

Eleven parts on these machines were required to be explosion-proof: (1) A controller; (2) two 65-horsepower motors; (3) three 10-horsepower motors; (4) two 3-horsepower motors; (5) a master switch; and (6) 2 headlights. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 300 feet of 400,000-c.m., 3-conductor, type G, flame-resistant cable for 220 volts and No. 4/0, 3-conductor, type G, flame-resistant cable for the other voltages. The cable is protected at the outby end by a circuit breaker set at 2,000 to 2,500 amperes for 220 volts and 1,500 to 1,800 amperes for the other voltages. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Types 3JCM-2B and 3JCM-3 D.-C. Continuous Miners

Approvals 2-773 and 2-773A, covering the designs of the types 3JCM-2B and 3JCM-3 continuous miners, were issued to the Joy Manufacturing Co. on December 14, 1950. The approvals apply to machines for operation from 250- and 500-volt, direct-current supplies.

Sixteen parts on these machines were required to be explosion-proof: (1) A controller and resistance compartment; (2) two 65-horsepower motors; (3) three 7-1/2-horsepower motors; (4) two 5-horsepower motors; (5) 2 connection boxes, 1 on each of the 65-horsepower motors; (6) a master switch and connection-box compartment; (7) 2 headlights; (8) 2 headlight resistance compartments; and (9) a control station. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machines through 300 feet of 3-conductor, flame-resistant cable, No. 4/0 for 250 volts and No. 2/0 for 500 volts. One conductor is used for a frame ground connection. The cable is protected at the outby and by a circuit breaker set at 2,200 to 2,500 amperes for 250 volts and 1,000 to 1,200 amperes for 500 volts. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Types 3JCM-2C and 3JCM-3C D.-C. Continuous Miners

Approvals 2-835 and 2-835A, covering the designs of the types 3JCM-2C and 3JCM-3C continuous miners, were issued to the Joy Manufacturing Co. on January 31, 1952. The approvals apply to machines for operation from 250- and 500-volt, direct-current supplies.

Thirteen parts (or 12 when a motor-generator is used to supply current for headlights) on these machines were required to be explosion-proof: (1) a controller and resistance compartment; (2) two 65-horsepower motors; (3) three 7-1/2-horsepower motors; (4) two 5-horsepower motors; (5) a master switch; (6) 2 headlights; and (7) 2 headlight resistance compartments. On 250-volt machines a motor-generator set may be used instead of the headlight resistor arrangement. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machines through 300 feet of No. 4/0, 3-conductor, round or No. 4/0, 2-conductor, parallel, type G, flame-resistant cable for 250 volts and No. 2/0, 3-conductor round or No. 2/0, 2-conductor, parallel, type G, flame-resistant cable for 500 volts. One of the conductors in the round cable is used for a frame ground connection. The cable is protected at the outby end by a circuit breaker set at 2,200 to 2,500 amperes for 250 volts and 1,200 amperes for 500 volts. An insulated strain clamp prevents strains on the terminal connections at the machine.

Types 3JCM-2C and 3JCM-3C A.-C. Continuous Miners

Approval 2-845A, covering the designs of the types 3JCM-2C and 3JCM-3C continuous miners, was issued to the Joy Manufacturing Co. on March 24, 1952. The approval applies to machines for operation from 440- and 500-volt, alternating-current supplies.

Eleven parts on these machines were required to be explosion-proof: (1) A controller; (2) two 65-horsepower motors; (3) a 10-horsepower motor; (4) two 7-1/2-horsepower motors; (5) two 3-horsepower motors; (6) a master switch; and (7) 2 head-lights.

The wiring between the various electrical parts is protected by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machines through 300 feet of 3-conductor, No. 4/0, type G, flame-resistant cable. The cable is protected at the outby end by a circuit breaker set at 1,500 to 1,800 amperes. An insulated strain clamp prevents strains on the terminal connections at the machine.

Types 4JCM-1B and 4JCM-2B A.-C. Continuous Miners

Approval 2-861A, covering the design of the 4JCM-1B continuous miner, was issued to the Joy Manufacturing Co. on May 21, 1952. The type 4JCM-2B was covered by an extension of approval dated February 24, 1954. The original approval applied to machines for operation from 440- and 550-volt supplies. The extension of February 24, 1954, was for 440-volt machines.

Twelve parts on these machines were required to be explosion-proof: (1) A controller; (2) two 65-horsepower motors; (3) one 10-horsepower motor; (4) two 7-1/2-horsepower motors; (5) two 3-horsepower motors; (6) a master switch; (7) 2 headlights; and (8) a transformer compartment. (The option of using one 7-1/2-horsepower motor for the two 3-horsepower motors was allowed for the 4JCM-1B design by an extension of approval.) In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 300 feet of No. 4/0, 3-conductor, type G, flame-resistant cable. The cable is protected at the outby end by a circuit breaker set at 1,500 to 1,800 amperes. An insulated strain clamp prevents strains on the terminal connections at the machine.

Type 4JCM-1B D.-C. Continuous Miner

Approvals 2-862 and 2-862A, covering the design of the type 4JCM-1B continuous miner, were issued to the Joy Manufacturing Co. on May 28, 1952. The approvals apply to machines for operation from 250- and 500-volt, direct-current supplies.

Thirteen parts (or 12 if a motor-generator set was used to supply current for headlights) on these machines as originally approved were required to be explosion-proof: (1) A controller and resistance compartment; (2) two 65-horsepower motors; (3) three 7-1/2-horsepower motors; (4) two 5-horsepower motors; (5) a master switch; (6) 2 headlights; (7) 2 headlight resistance compartments, or, on 250-volt machines a motor-generator set may be used instead of the headlight resistor arrangement. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

Later, under the date of July 11, 1953, hydraulic roof-bolting drills were added as optional on the 250-volt machine. A motor and a controller were added in connection with these drills.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 300 feet of No. 4/0, 3-conductor, round, or No. 4/0, 2-conductor, type G, parallel, flame-resistant cable for 250 volts and No. 2/0, 3-conductor, round, or No. 2/0, 2-conductor, type G, parallel, flame-resistant cable for 500 volts. One conductor of the round cables is used for a frame ground connection. The cable is protected at the outby end by a circuit breaker set at 2,200 to 2,500 amperes for 250 volts and 1,000 to 1,200 amperes for 500 volts. An insulated strain clamp prevents strains on the terminal connections at the machine.

Type 3JCM-2B A.-C. Continuous Miner

Approval 2-868A, covering the design of the type 3JCM-2B continuous miner, was issued to the Joy Manufacturing Co. on July 16, 1952. The approval applies to machines for operation from a 440-volt, alternating-current supply.

Twelve parts on these machines were required to be explosion-proof: (1) A controller; (2) two 65-horsepower motors; (3) a 10-horsepower motor; (4) two 7-1/2-horsepower motors; (5) two 3-horsepower motors; (6) a control station; (7) a master switch and connection box compartment; and (8) 2 headlights. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 300 feet of No. 4/0, 3-conductor, type G, flame-resistant cable. The cable is protected at the outby end by a circuit breaker set at 1,500 to 1,800 amperes. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Type 2WM-1 D.-C. Walking Miner

Approvals 2-901 and 2-901A, covering the design of the type 2WM-1 walking miner, issued to the Joy Manufacturing Co. on January 28, 1953. The approvals apply to machines for operation from 250- and 500-volt, direct-current supplies.

Ten parts for these machines were required to be explosion-proof: (1) A controller; (2) two 65-horsepower motors; (3) two 5-horsepower motors; (4) 2 head-lights; (5) 2 headlight resistance boxes; and (6) a skid-mounted, remote-control compartment.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machines as originally approved through a 25-foot length of cable from the supply to the skid-mounted controller. A 300-foot length of cable went from the skid-mounted controller to the controller mounted on the machine proper. The 25-foot cable was 3-conductor, 4/0 for 250 volts and 2/0 for 500 volts, flame-resistant cable. The 300-foot cable was the same as the 25-foot cable except that it was type G construction. An extension of approval has allowed a sectionalized cable between the 2 controllers for 250-volt machines. One section of cable has three 4/0 and three No. 10 conductors, whereas the other sections have three 4/0 and five No. 10 conductors. An intrinsically safe control circuit allows the sections to be coupled without explosion or fire hazard. Short-circuiting the 2 conductors in the last couple in connection, the intrinsically safe control circuit accounts for the 2 fewer conductors in 1 cable section. One of the conductors is used for a frame ground connection. The cables are protected by a circuit breaker set at 1,800 amperes for 250 volts and 1,000 amperes for 500 volts. Insulated strain clamps prevent strains on the terminal connections.

Type LCM-1 D.-C. Continuous Miner

Approval 2-934, covering the design of the type LCM-1 continuous miner, was issued to the Joy Manufacturing Co. on May 4, 1953. The approval applies to machines for operation from a 250-volt, direct-current supply.

Twelve parts on the machine as originally approved were required to be explosion-proof: (1) A controller and resistance compartment; (2) two 65-horsepower motors; (3) a 15-horsepower motor; (4) four 7-1/2-horsepower motors; (5) a master switch; (6) a motor-generator; and (7) 2 headlights. In addition to the parts listed, an explosion-proof meter and switch compartment was added by an extension of the approval. Some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 300 feet of No. 4/0, 2-conductor, parallel, type G, flame-resistant cable. The cable is protected at the outby end by a circuit breaker set at 1,800 amperes. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Type LCM-1 A.-C. Continuous Miner

Approval 2-971A, covering the design of the type LCM-1 continuous miner, was issued to the Joy Manufacturing Co. on December 7, 1953. The approval applies to machines for operation from 440-volt, alternating-current supplies.

Eleven parts on this machine were required to be explosion-proof: (1) A control compartment; (2) two 65-horsepower motors; (3) a 15-horsepower motor; (4) two 7-1/2-horsepower motors; (5) two 3-horsepower motors; (6) 2 headlights; and (7) a master switch. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 300 feet of No. 4/0, type G, flame-resistant cable. The cable is protected at the outby end by a circuit breaker set at 1,500 to 1,800 amperes. An insulated strain clamp prevents strains on the terminal connections at the machine.

Type 1CM-2 D.-C. Continuous Miner

Approval 2-1007, covering the design of the 1CM-2 continuous miner, was issued to the Joy Manufacturing Co. on July 2, 1954. The approval applied to machines for operation from 250-volt, direct-current supply. The approval was extended under date of October 26, 1954, to cover machines for operation from 500-volt, direct-current supply.

Twelve parts on the machine as originally approved were required to be explosion proof: (1) A controller and resistance compartment; (2) two 65-horsepower motors; (3) a 15-horsepower motor; (4) four 7-1/2-horsepower motors; (5) a master switch; (6) 2 headlights; (7) a motor-generator; and (8) a meter and switch compartment. In addition to the parts listed, some connection boxes that were not required to be explosion-proof by the Bureau's schedule were explosion-proof also. The design for 500-volt operation allowed by extension of approval omits the motor generator and adds 2 headlight resistance compartments. Also, the two 65-horsepower motors were replaced by two 100-horsepower motors. A later extension of approval also allows 100-horsepower main motors on a 250-volt design.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machines through 300 feet of 2-conductor, No. 4/0, parallel type G, flame-resistant cable for 250 volts and 3-conductor, No. 2/0, flame-resistant cable for 500 volts. The cables are protected at the outby ends by circuit breakers set at 1,800 amperes for 250 volts and 1,000 amperes for 500 volts. Insulated mechanical strain clamps prevent strains on the terminal connections at the machines. Also, an extension of approval allowed a 3-conductor, No. 4/0 cable for a 250-volt design. One of the conductors of the 3-conductor cable is used for a frame ground connection.

APPROVED MACHINES BUILT BY THE JEFFREY MANUFACTURING CO.

Type 76-A D.-C. Colmol Mining Machines

Approvals 2-749 and 2-749A, covering the design of the Type 76-A Colmol mining machine, were issued to The Jeffrey Manufacturing Co. on August 8, 1950. The approvals apply to machines for operation from 250- and 500-volt, direct-current supplies. Figure 5 shows a late-type 76-A Colmol mining machine.

The 15 rotating breaker arms shown at the front of the machine in the picture are so arranged that every part of the coal face is covered. The arms carry cutter bits that break the coal from the face. The motion of the arms is toward the center of the machine at the bottom, so that the loose coal is swept to the center, where it is forced onto the conveyor as the machine advances.

The machine is powered by three 50-horsepower motors. Two of the motors are toward the front of the machine, one on each side, and they drive the breaker arms. The third motor furnishes power for all the other functions. All drives on the machine as originally approved were actually operated hydraulically by pumps and hydraulic motors.

As originally approved, this machine had 13 explosion-proof electrical parts: (1) Three 50-horsepower motors; (2) a control compartment; (3) 5 motor resistance compartments; (4) a headlight resistance; (5) 2 headlights; and (6) a rear light.

Some electrical parts of the machine illustrated can be seen, whereas others are obscured by various features. Thus, a motor is at a, the controller at b, and a resistance box at c.

The wiring between the various electrical parts is protected from mechanical injury by conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the 250-volt machine as originally approved through 2 lengths of 500 feet or less of 350,000-c.m., flame-resistant, single-conductor cable. A single-conductor, 4/0, flame-resistant cable was used for the frame ground wire. Power was conducted to the 500-volt machine through 500 feet or less of 3-conductor, 4/0 or 4/0 flat twin, type G, flame-resistant cable.

The cable was protected at the outby end by a 300-ampere, fused trolley tap for 500-volt machines and by a 600-ampere fuse in a small fuse box for 250-volt machines. An insulated mechanical strain clamp prevents strain on the terminal connections at the machine.

A number of optional arrangements have been allowed by the extensions of the original approvals - an emergency switch was added, options as to the number of lights have been allowed, the headlight resistance has been placed in a motor-resistance box, and the separate headlight resistance box was omitted in one design. Three designs use a mechanical instead of an hydraulic drive for the breaker arms. On these machines one motor-resistance box was used instead of a number, and an auto feed control compartment was added. In two of these machines a push button box is used to provide for dual control and the emergency switch is eliminated.

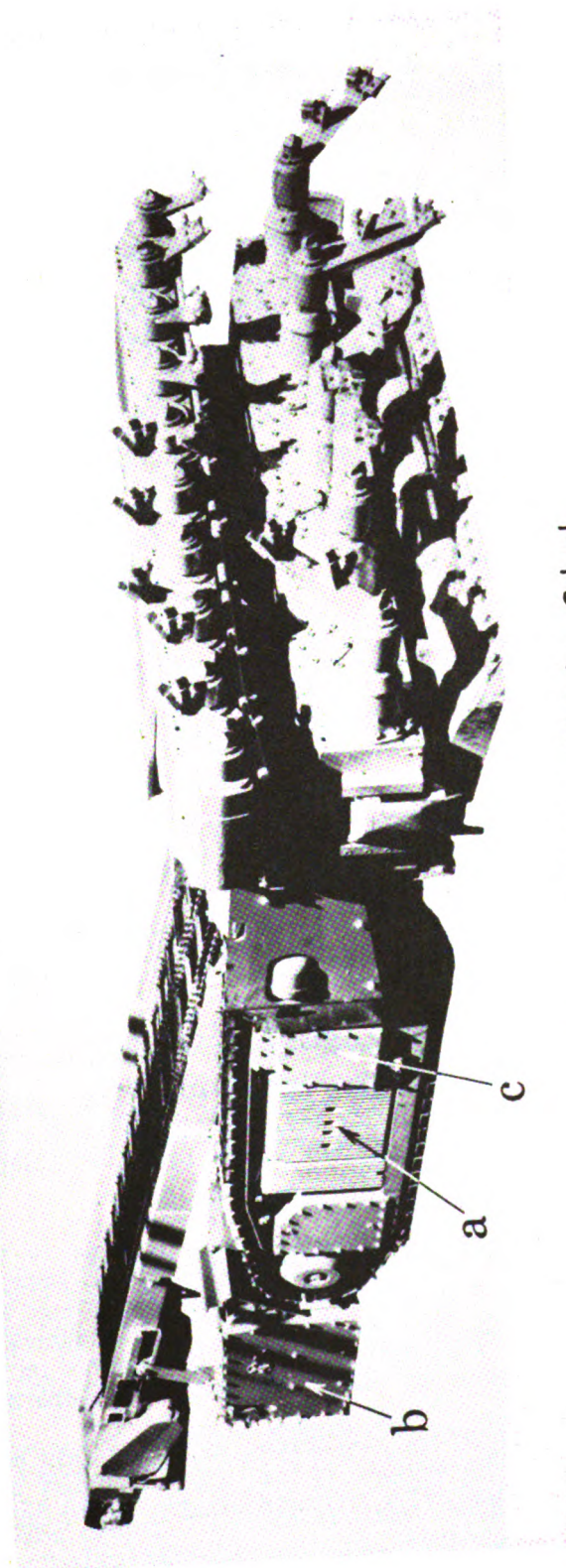


Figure 5. - Jeffrey type 76-A d.-c. Colmol.

Type 76-B D.-C. Colmol Mining Machine

Approval 2-808, covering the type 76-B design of the Colmol mining machine, was issued to The Jeffrey Manufacturing Co. on September 7, 1951. The approval applies to machines for operation from a 250-volt, direct-current supply.

In operation this machine is quite similar to the type 76-A machine described in connection with Approvals 2-749 and 2-749A. It is powered by three 70-horsepower motors. Two motors are toward the front of the machine, one on each side, and furnish power for driving the breaker arms. The third motor furnishes power for all the other functions. All drives on the machine as originally approved were actually operated hydraulically by pumps and hydraulic motors.

There were 7 explosion-proof electrical parts on this machine as originally approved: (1) Three 70-horsepower; (2) a control compartment; (3) a resistance compartment; (4) a light, and (5) an emergency switch.

The wiring between the various electrical parts is protected from mechanical injury by conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power was conducted to the machine through 2 lengths, 500 feet or less, of 500,000-c.m., flame-resistant, single-conductor cables. A single-conductor, 250,000-c.m., flame-resistant cable was used for the frame ground wire. The cable was protected at the outby end by two 400-ampere fuses in parallel in a small fuse box. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Two optional arrangements of the machine have been allowed by extensions of the approval. In the first of these a mechanical instead of a hydraulic drive was used for the breaker arms. On this optional design 2 resistance compartments, 2 lights, and 1 auto-feed-control compartment were used. The second optional arrangement was equipped similarly to the original design, except that 2 lights instead of 1 were used.

Type 76-B A.-C. Colmol Mining Machine

Approval 2-966A, covering the design of the type 76-B, alternating-current Colmol mining machine, was issued to The Jeffrey Manufacturing Co. on November 9, 1953. The approval applies to machines for operation from a 440-volt, alternating-current supply.

In operation this machine is quite similar to the type 76-A direct-current machine described in connection with Approvals 2-749 and 2-749A. It is powered by 3 motors, two 70-horsepower and one 50-horsepower. The two 70-horsepower motors furnish power for driving the breaker arms. The 50-horsepower motor furnishes power for all the other functions. All of the drives on the machine are actually carried out hydraulically by pumps and hydraulic motors.

There were eight explosion-proof electrical parts on this machine: (1) Two 70-horsepower motors; (2) a 50-horsepower motor; (3) a control box; (4) 2 lights; (5) a push-button switch box; and (6) a circuit breaker and plug box.

The wiring between the various electrical parts is protected from mechanical injury by conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power is conducted to the machine through No. 2/0, 3-conductor, type G, flame-resistant cable, 500 feet (or less) long. The cable is protected at the outby end by three 300-ampere fuses. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

No extensions of this approval to allow changes have been granted.

Type 76-A A.-C. Colmol Mining Machine

Approval 2-985, covering the design of the type 76-A, alternating-current, Colmol mining machine, was issued to The Jeffrey Manufacturing Co. on February 26, 1954. The approval applied to machines for operation from a 220-volt, alternating-current supply. Under date of April 19, 1954 Approval 2-985A was issued for machines for operation from a 440-volt, alternating-current supply.

In operation this machine is quite similar to the type 76-A direct-current machine described in connection with Approvals 2-749 and 2-749A. It is powered by three 50-horsepower motors. Two of the motors furnish power for driving the breaker arms. The other motor furnishes power for all the other functions. All of the drives on the machine are actually carried out hydraulically by pumps and hydraulic motors.

There were eight explosion-proof electrical parts on this machine: (1) Three 50-horsepower motors; (2) a control box; (3) 2 lights; (4) a push button switch box; and (5) a headlight resistance on 220-volt or a transformer on 440-volt machines.

The wiring between the various electrical parts is protected from mechanical injury by conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power is conducted to 220-volt machines through 3 single conductor, 250,000 c.m. cables, and a No. 2/0 cable is used for the frame ground. For 440-volt machines the cable is 4-conductor, No. 2/0. These cables are 500 feet or less in length and are flame resistant. Protection at the outby end of the cables for 220-volt machines is provided by three 750-ampere fuses or by a circuit breaker set at 1,500 amperes. For 440-volt machines, three 400-ampere fuses or a circuit breaker set at 1,000 amperes is used. An insulated strain clamp prevents strains on the terminal connections for the cables at the machine.

Type MM-34F-52 Mining Machine

Approval 2-888A, covering the design of the type MM-34F-52 mining machine, was issued to The Jeffrey Manufacturing Co. on December 3, 1952. This original approval applied to machines for operation from a 500-volt, direct-current supply. Under date of December 15, 1954, Approval 2-888 was issued for machines for operation from a 250-volt, direct-current supply.

The machine consists of two separate units. Figure 6 shows the crawler-mounted unit that takes the coal from the face. Figure 7 shows the power-supply unit. The two units are electrically connected by two 9-conductor, flame-resistant cables. These cables are in 100-foot lengths equipped with plug and socket connectors and carry intrinsically safe pilot circuits so arranged that the cables can be connected and disconnected without hazard.

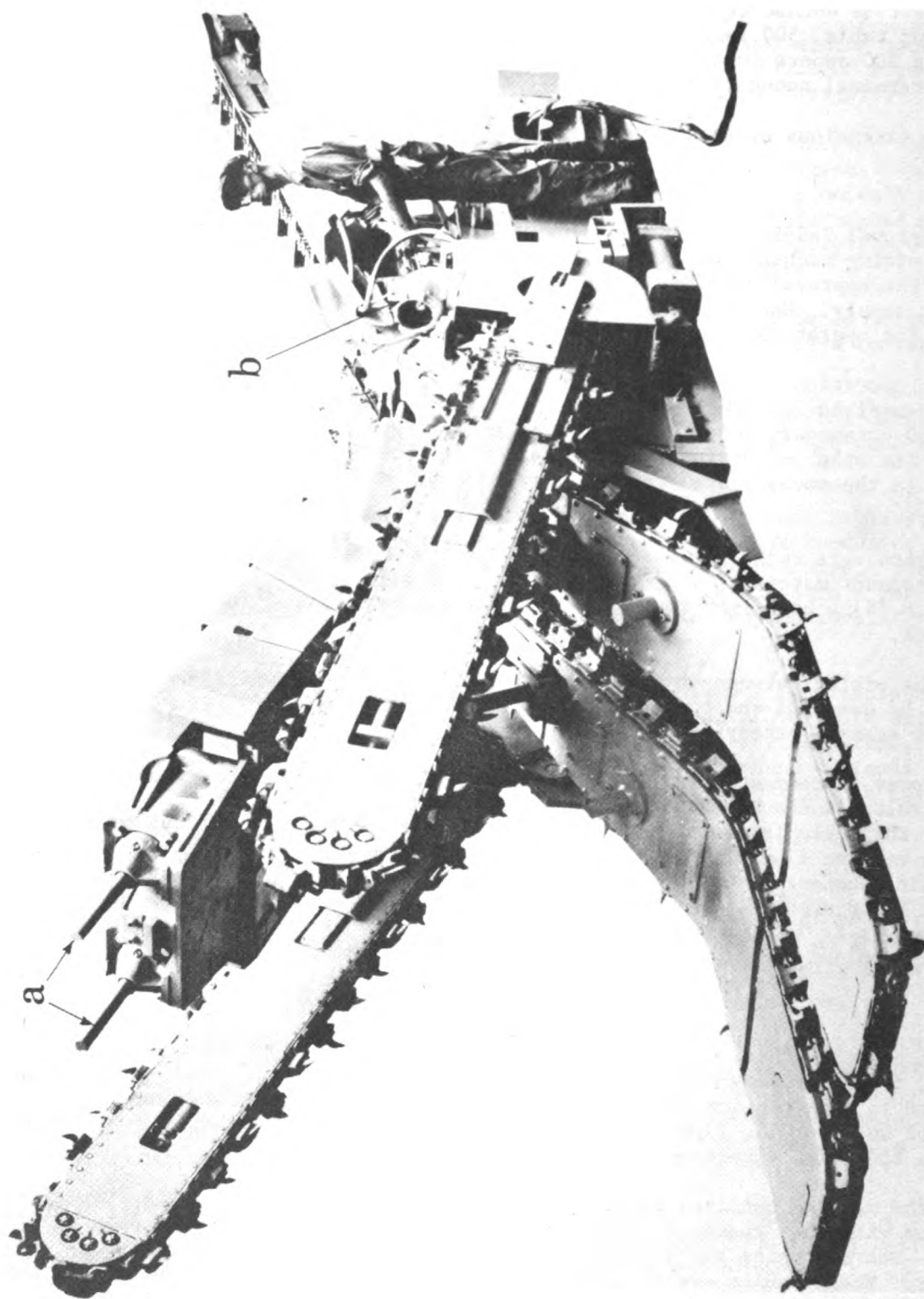


Figure 6. - Jeffrey type MM-34F-52 mining machine.

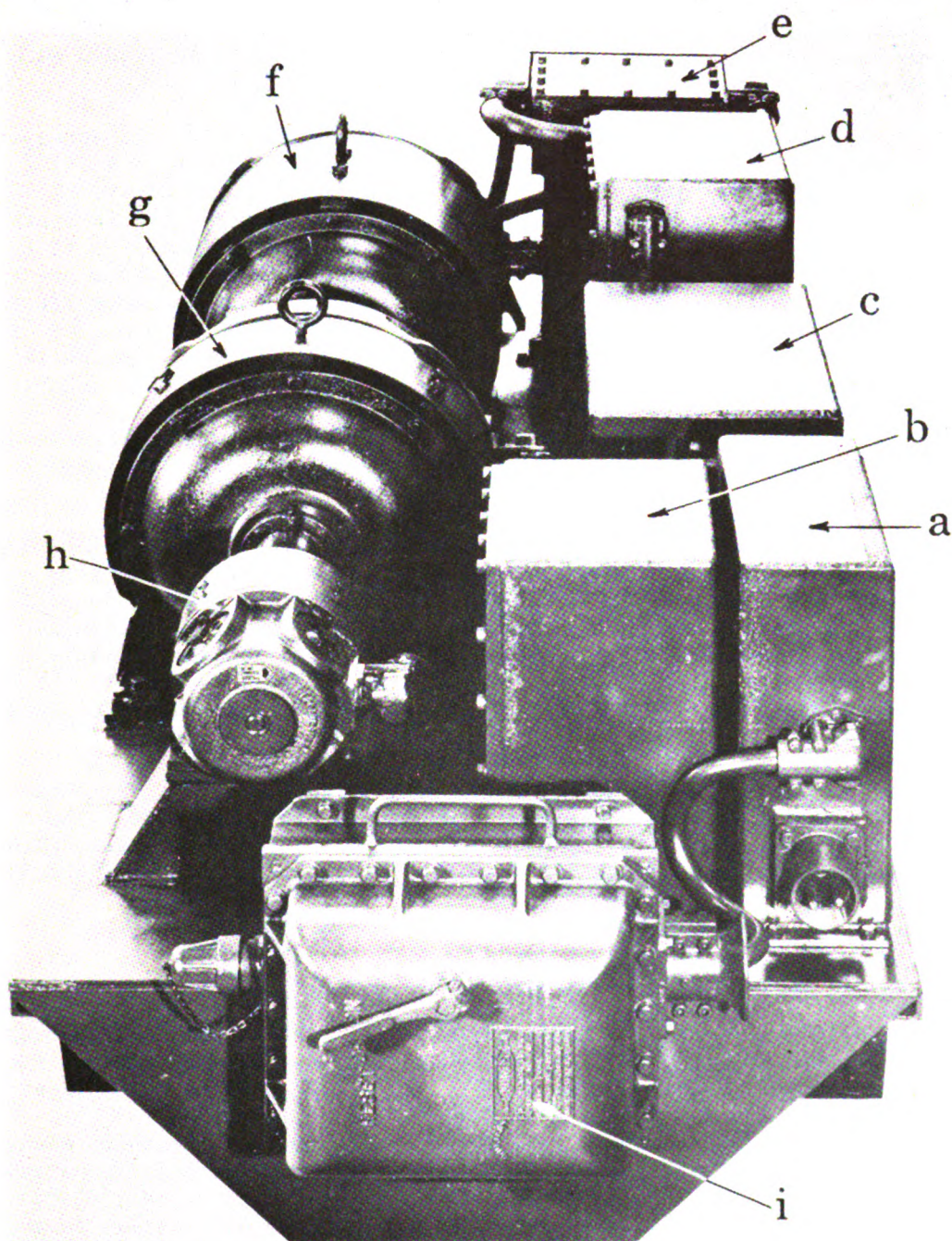


Figure 7. - Jeffrey type MM-34F-52 mining machine.

In operation, the coal is undercut and sheared by the four cutter chains, producing a hanging block of coal. The two rapidly vibrating Syntron hammers striking this block cause the coal to fall from the face. The fallen coal is swept onto the conveyor, which carries it to the rear of the machine where it is loaded onto haulage equipment.

The electrical parts on the face unit, figure 6, were: (1) A 75-horsepower motor; (2) a starting box; (3) 2 emergency switches; (4) 2 lights; and (5) 2 Syntron hammers. The power supply unit, figure 7, carried the following parts: A 15-horsepower controller at a, a resistor at b, a 75-horsepower starter at c, a Syntron hammer control at d, a rectifier at e, an alternating-current generator at f, a 15-horsepower motor at g, an exciter at h, and on the original design a power take-off at i. The alternating-current generator and rectifier supply power for the Syntron hammers. In figure 6 only the 2 Syntron hammers at a and 1 of the headlights at b can be readily seen. A start switch has been added to the parts on this unit by extension of approval.

The wiring between the various electrical parts is protected from mechanical injury by conduits and by position. Appropriate overload devices are used to protect against excessive overcurrents.

Power is conducted from the source to the power unit by 100-foot lengths of 5-conductor, flame-resistant cable. For 500 volts, the 2 power conductors and the ground conductor are each No. 1/0 size and the 2 pilot wires are No. 10 size. For 250 volts the 2 power conductors are each 4/0 size, and the ground conductor is 1/0 size. The two pilot wires are No. 10 size. The 100-foot lengths of cable are equipped with connectors, and the intrinsically safe circuit carried by the pilot wires is so arranged that the cable can be connected and disconnected without hazard.

The cable is protected at the outby end by a circuit breaker. The breaker setting is 850 amperes for 500 volts and 1,700 amperes for 250 volts. The circuit-breaker unit is also essential in connection with the intrinsically safe circuit that functions to provide for safe connections and disconnections of the cables.

APPROVED MACHINES BUILT BY THE LEE-NORSE CO.

Model CM46-1 Koal Master

Approval 2-783, covering the design of the Model CM46-1 Koal Master, was issued to the Lee-Norse Co. on April 10, 1951. The approval applies to machines for operation from a 250-volt, direct-current supply. Figure 8 shows the CM6-1 Koal Master.

This is essentially a rubber-tire-mounted machine with a mechanism mounted on its front end for removing coal from the solid face. This mechanism consists of 2 heads each carrying 5 disks on which are mounted cutting bits. These disks rotate about horizontal axes. The two heads are pivoted and move alternately toward and away from each other in a horizontal direction. In operation the heads are sumped into the coal at the top of the seam and then swing downward dislodging the coal as they move. The loose coal is fed to a conveyor at the center of the machine by the loading mechanism. The conveyor at the rear delivers the coal to haulage equipment for transportation to the surface.

There were 13 explosion-proof electrical parts on this machine: (1) Two 60-horsepower motors; (2) a 15-horsepower motor; (3) a starter for the 60-horsepower

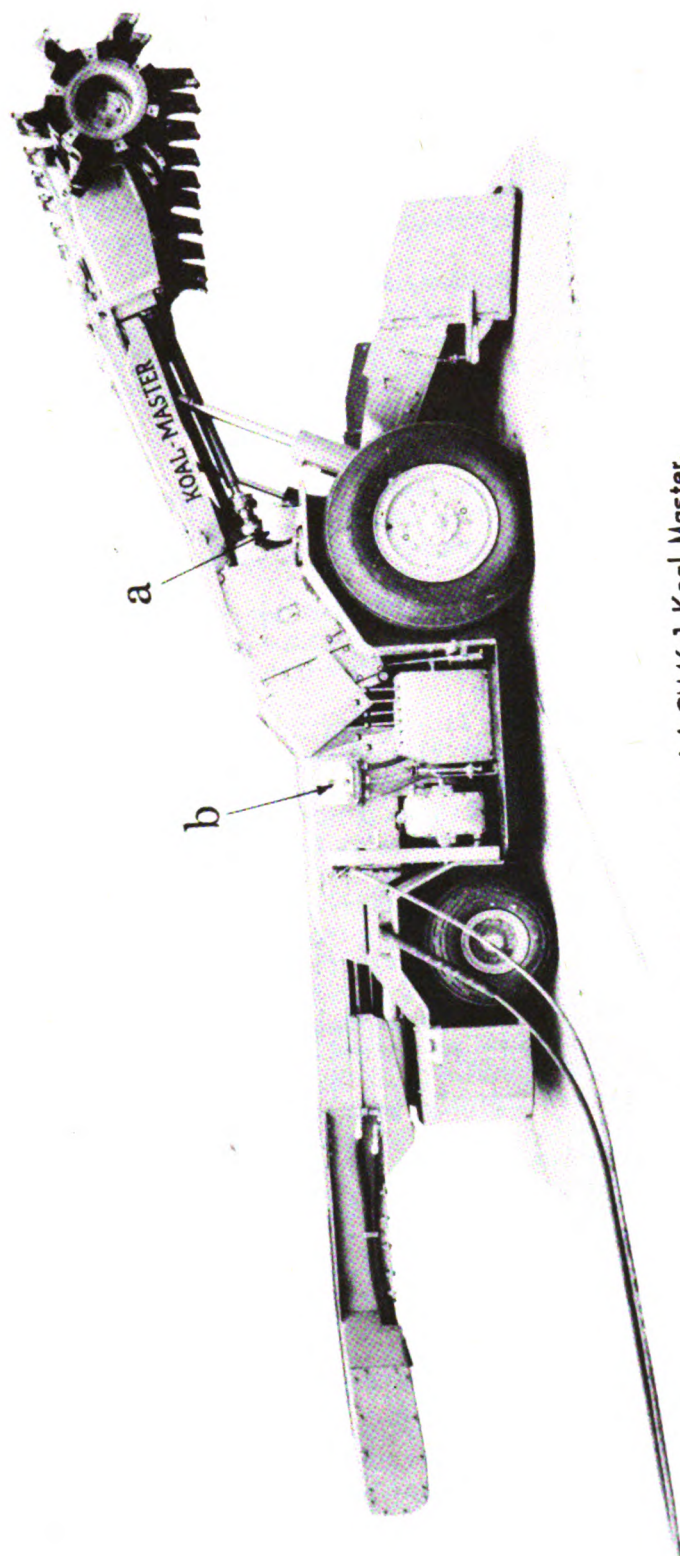


Figure 8. - Lee-Norse model CM46-1 Koal Master.

motors; (4) a starter for the 15-horsepower motor; (5) a control station; (6) 3 headlights; (7) a headlight resistance; (8) a headlight relay; (9) a control station; and (10) a circuit breaker. Some of these parts can be seen in figure 8, but many are obscured by other parts of the machine. A headlight is at a and a control station at b.

The wiring between the various electrical units is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through 300 feet of No. 2/0, type G, flame-resistant, portable cable. The cable is protected by a circuit breaker set at 1,000 amperes at the outby end. The cable is held by a strain clamp to prevent strains on the terminal connections at the machine.

Model CM50 Miner

Approval 2-881, covering the design of the Model CM50 miner, was issued to the Lee-Norse Co. on November 3, 1952. The approval applies to machines for operation from a 250-volt, direct-current supply.

The Model CM50 miner is a caterpillar-mounted machine. It operates in the same general manner as the Model CM46-1 machine previously described. It differs from that machine in that each of the 2 heads has only 2 revolving disks with cutter bits instead of 5.

There were 11 explosion-proof electrical parts on the Model CM50 miner: (1) Two 60-horsepower motors; (2) one 15-horsepower motor; (3) one 5-horsepower motor; (4) a controller; (5) a resistor; (6) a control station; (7) 2 headlights; (8) a headlight resistance; and (9) a circuit breaker.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through 500 feet of 2/0 type G, flame-resistant, portable cable. The cable is protected by a circuit breaker set at 1,000 amperes at the outby end. The cable is held by a strain clamp to prevent strains on the terminal connections at the machine.

Several optional parts have been allowed by extensions of the approval as follows: (1) Two 30-horsepower motors in place of the original 60-horsepower motor; (2) a 20-horsepower motor in place of the 15-horsepower motor; (3) a 6-horsepower motor in place of the 5-horsepower motor; (4) modified 60-horsepower motors in place of the original 60-horsepower motors. Also, a modified controller compartment has been included.

Model CM-32 Miner

Approval 2-954, covering the design of the Model CM-32 miner, was issued to the Lee-Norse Co. on September 14, 1953. The approval applies to machines for operation from a 250-volt, direct-current supply.

The Model CM-32 miner is mechanically similar to the Model CM-50 described in connection with Approval 2-881. The present machine, however, is for use in low seams.

There were 10 or 11 explosion-proof electrical parts on the Model CM-32 miners, depending on whether 1 or 2 headlights were used: (1) Two 20-horsepower motors; (2) two 6-horsepower motors or optional 5-horsepower motors; (3) a 10-horsepower motor; (4) 2 magnetic controllers; (5) a control station; (6) 1 or 2 headlights; and (7) a headlight resistance.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through its 500-foot length of No. 1, twin parallel, type G, flame-resistant, portable cable. The cable is protected by a circuit breaker set at 1,000 amperes at the outby end. The cable is held by a strain clamp to prevent strains on the terminal connections at the machine.

Model CM-36 Miner

Approval 2-973, covering the design of the Model CM-36 miner, was issued to the Lee-Norse Co. on December 21, 1953. The approval applies to machines for operation from a 250-volt, direct-current supply. Figure 9 shows the Model CM-36 miner.

The Model CM-36 miner is a caterpillar-mounted machine similar to the Model CM-32 of Approval 2-954 which it supersedes. Therefore it is mechanically similar to the Model CM-50 described in connection with Approval 2-881.

There were 10 or 11 explosion-proof electrical parts on this machine, depending on whether 1 or 2 headlights are used: (1) Two 40-horsepower motors; (2) a 15-horsepower motor; (3) two 10- or 8-horsepower motors; (4) 2 magnetic controllers; (5) a control station; (6) 1 or 2 headlights; and (7) a headlight resistance. Some of these parts can be seen in figure 9, but some are obscured by other parts of the machine. One of the motors driving the cutters is at a, the pump motor is at b, the conveyor motors are at c, one of the magnetic controllers is at d, and the headlight can be seen at e.

The wiring between the various electrical parts is protected by hose conduit and by position from mechanical injury. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through its 500-foot length of No. 1 twin-parallel, type G, flame-resistant, portable cable. The cable is protected by a circuit breaker set at 1,000 amperes at the outby end. The cable is held by a strain clamp to prevent strains on the terminal connections at the machine.

Redesigned Model CM-50 Miner

Approval 2-994, covering the design of the redesigned Model CM-50 miner, was issued to the Lee-Norse Co. on April 30, 1954. The approval applies to machines for operation from a 250-volt, direct-current supply.

This machine varies somewhat both electrically and mechanically from the original Model CM-50 miner described in connection with Approval 2-881. It is a caterpillar-mounted machine and operates in the same general manner as the Model CM46-1 machine previously described. However, each of the 2 heads has only 2 revolving disks with cutter bits instead of 5.

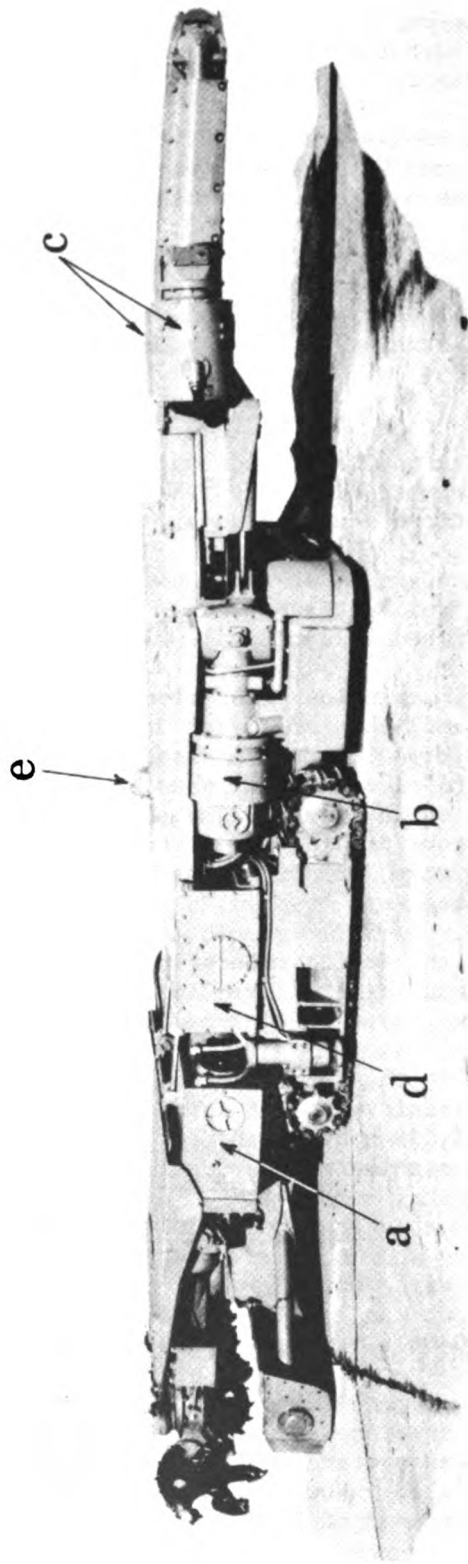


Figure 9. - Lee-Norse model CM-36 miner.

There were 11 explosion-proof electrical parts on the redesigned Model CM-50 miner: (1) Two 40-horsepower motors; (2) two 10- or 8-horsepower motors; (3) a 20-horsepower motor; (4) a controller; (5) a resistor case; (6) a control station; (7) 2 headlights; and (8) a headlight resistance. A 40-horsepower motor in place of the 20-horsepower motor has been authorized by an extension of the approval.

The wiring between the various electrical parts is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through 500 feet of No. 2/0, 2-conductor, type G, flame-resistant cable. The cable is protected by a circuit breaker set at 1,000 amperes at the outby end. The cable is held by a strain clamp to prevent strains on the terminal connections at the machine.

APPROVED MACHINES BUILT BY THE MARIETTA MANUFACTURING CO.

Marietta Miner, Layout Drawing 31772

Approval 2-922, covering the design of the Marietta miner (layout drawing 31772), was issued to the Marietta Manufacturing Co. on April 6, 1953. The approval applies to machines for operation from a 250-volt, direct-current supply. Figure 10 shows this Marietta miner. The cutting bits are not shown in the illustration.

The Marietta miner is a boring-type machine. The coal is dislodged from the solid coal face by 2 rotating heads, each having 2 arms holding cutting bits and producing overlapping circular kerfs. A drilling bit at the center of each head acts to break the center core. Cutter chains cut off the wedges of coal left at the top and bottom with the rotating cutter heads. The coal dislodged from the face falls down and is pushed toward the center of the machine by the rotating arms and is forced onto the chain conveyor by the forward motion of the machine as it advances on its caterpillar treads. The conveyor chain and the caterpillar treads are driven by hydraulic motors.

Power for driving the two rotating heads and for the cutter chains is supplied by one motor through a suitable shear coupling and reduction gear assemblies. All other functions of the machine are performed hydraulically. Another motor drives the hydraulic pumps.

There were 12 explosion-proof electrical parts on this machine: (1) A 70-horsepower motor driving the cutting elements; (2) a 25-horsepower motor driving the hydraulic pumps; (3) a master control; (4) a control group; (5) an emergency stop switch; (6) 4 resistance boxes; (7) 2 headlights; and (8) a tail light. Some of these can be seen in figure 10, but most of them are obscured by other parts of the machine.

The 25-horsepower motor driving the hydraulic pumps is at a, the control group is at b, 1 of the headlights is at c, and the tail light is at d.

The wiring between the various electrical units is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

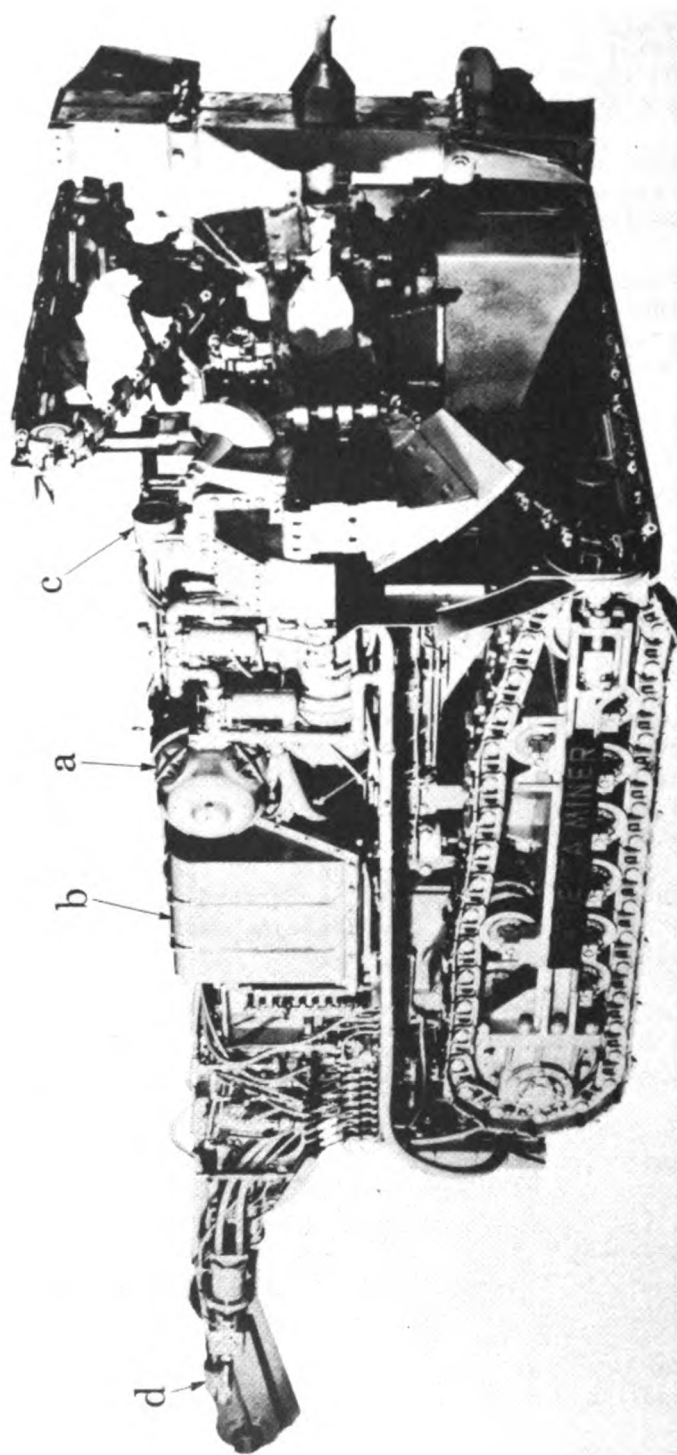


Figure 10. - Marietta miner.

Power is conducted to the machine through 2 lengths (500 feet or less) of 250,000-c.m., single-conductor, flame-resistant, portable cable. A single-conductor 2/0, flame-resistant cable is used for the frame ground. The cable is protected by a circuit breaker set to trip at 600 amperes at the outby end. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Marietta Miner, Layout Drawing 31787

Approval 2-957, covering the design of the Marietta miner (layout drawing 31787), was issued to the Marietta Manufacturing Co. on October 13, 1953. The approval applies to machines for operation from a 250-volt, direct-current supply.

In general, this machine is quite similar to that described in connection with Approval 2-922. Two 70-horsepower motors are used on the present machine instead of one 70- and one 25-horsepower motor as used on the machine of Approval 2-922. The second 70-horsepower motor, besides driving the hydraulic pumps, supplies its excess power to the coal-cutting gear train through a friction clutch.

There were 13 explosion-proof electrical parts on this machine: (1) Two 70-horsepower motors; (2) a controller; (3) a control group; (4) an emergency control switch; (5) 4 resistance boxes; (6) 2 headlights; (7) a tail light; and (8) a warning light.

The wiring between the various electrical units is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through 2 lengths (500 feet or less) of 350,000-c.m., single-conductor, flame-resistant, portable cables. A single-conductor 4/0, flame-resistant cable is used for the frame ground. The cable is protected by a circuit breaker set to trip at 800 amperes at the outby end. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

Marietta Miner, Layout Drawing 31804

Approval 2-990, covering the design of the Marietta miner (layout drawing 31804), was issued to the Marietta Manufacturing Co. on March 17, 1954. The approval applies to machines for operation from a 250-volt, direct-current supply.

In general, this machine is quite similar to those covered by Approvals 2-922 and 2-957 as already described. One 70-horsepower motor and one 25-horsepower motor are used on the present machine.

There were 12 explosion-proof electrical parts on this machine: (1) A 70-horsepower motor; (2) a 25-horsepower motor; (3) 2 controllers; (4) a control switch; (5) 4 resistance boxes; (6) 2 headlights; and (7) a tail light.

The wiring between the various electrical units is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through 2 lengths (500 feet or less) of 250,000-c.m., single-conductor, flame-resistant, portable cables. A single-conductor, 2/0, flame-resistant cable is used for the frame ground. The power cables are

protected by a circuit breaker set to trip at 600 amperes at the outby end. An insulated mechanical strain clamp prevents strains on the terminal connections at the machine.

APPROVED MACHINES BUILT BY THE GOODMAN MANUFACTURING CO.

Types E-2600 and 2600 Mining and Loading Machines

Approval 2-765, covering the design of the type E-2600 mining and loading machine, was issued to the Goodman Manufacturing Co. on November 6, 1950. The approval applies to machines for operation from a 250-volt, direct-current supply. Only one of the type E-2600 machines has been built, and it has been replaced by the type 2600 mining and loading machine whose design was covered by an extension of Approval 2-765 granted March 2, 1954. Figure 11 shows the type 2600 machine. The timber-setting arms are optional.

In operation the cutting head a is sumped into the coal at the top of the face by advancing the machine on its caterpillar treads. The cutting head is then swung downward to the bottom, the moving bits dislodging the coal as the head travels downward. The loose coal is swept onto a conveyor that runs through the center of the machine by the gathering arms b. The cutting bits are carried by 2 cutter chains, 1 on each side of the head, and a revolving drum between the 2 chains. (The cutting bits are not shown in place in the tool holders on the illustration.) The cutting head can be swung horizontally through an arc on each side of the center line of the machine. Also, the rear conveyor c can be swung horizontally to either side of the center line and raised or lowered.

There were 25 explosion-proof electrical parts on this machine: (1) Two 75-horsepower motors, each driving the cutter chains; (2) two 8-horsepower motors, driving the rear conveyor; (3) an 8-horsepower motor driving a hydraulic pump; (4) two 7-1/2-horsepower motors driving the caterpillar treads for tramping; (5) 2 contactor and relay cases; (6) 10 resistance cases; (7) a tramping controller; (8) a remote-control station for the hydraulic pump; (9) a start-stop push button for the cutter-chain motors; (10) 2 headlights; and (11) a headlight switch. Some of these accessories can be readily seen in figure 11, but many of them are obscured by other parts of the machine. One of the motors driving the cutter chain is at d, one of the rear conveyor motors is at e, one of the contactor and relay cases is at f, a controller is at g, a push button is at h, and a switch is at j. The 2 headlights are plainly visible, 1 on either side near the front of the machine.

The wiring between the various electrical units is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through 500 feet or less of 4/0, parallel-duplex, type G, flame-resistant, portable cable. The cable is protected by a 1,200-ampere instantaneous trip circuit breaker at the outby end. A mechanical strain clamp held by the chains i prevents strains on the terminal connections at the machine.

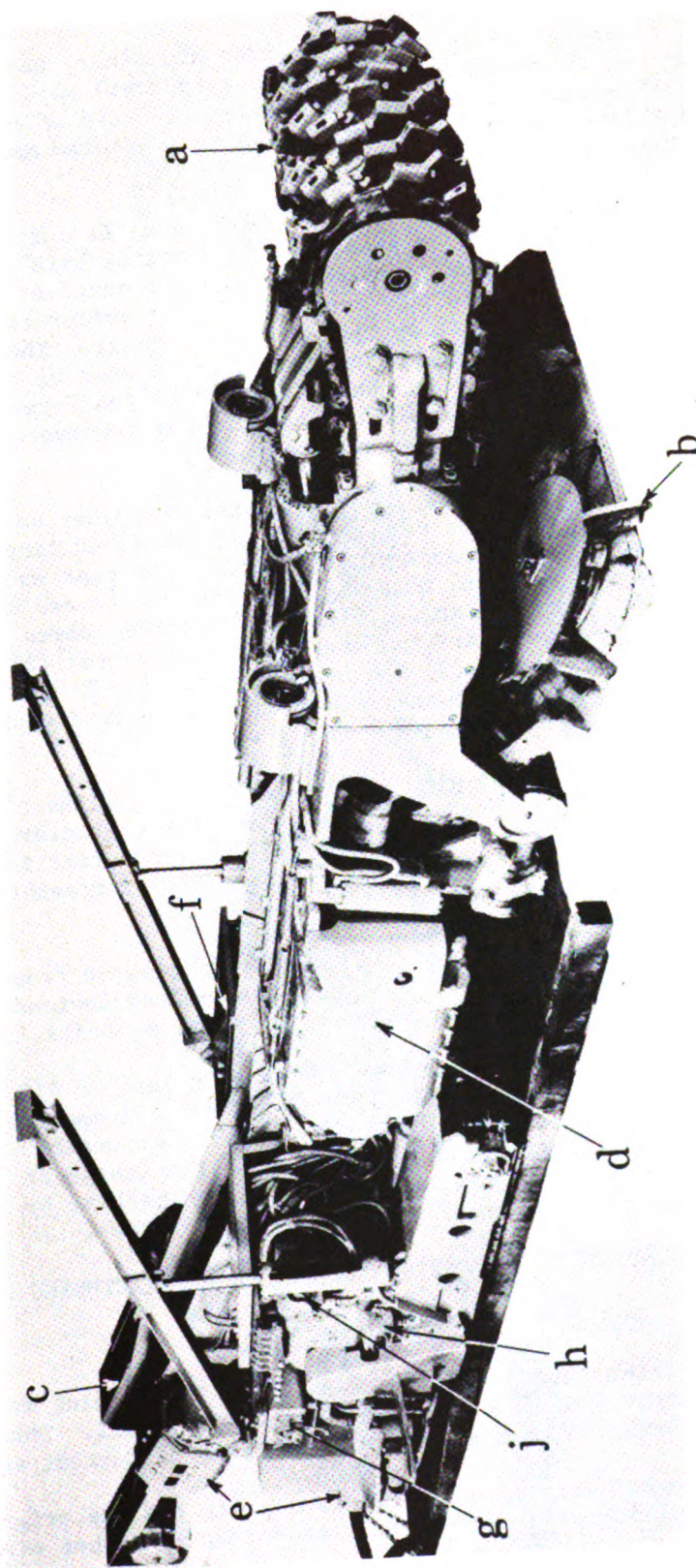


Figure 11. - Goodman type 2600 mining-loading machine.

Type 500 Miner

Approval 2-974, covering the design of the type 500 miner, was issued to the Goodman Manufacturing Co. on December 21, 1953. The approval applies to machines for operation from a 250-volt, direct-current supply. The use of an optional contactor case has been allowed by an extension of approval granted March 5, 1954. Figure 12 shows the type 500 miner.

The type 500 miner is a boring-type machine. The coal is cut from the solid face by 2 rotating heads, each having 3 arms, holding cutting bits and producing overlapping circular kerfs. A conically shaped screw is located at the center of each revolving head and acts to break the central core. A cutter chain cuts off the top and bottom wedges of coal left by the rotating cutters. The coal dislodged from the face falls down and is pushed toward the center of the machine by the rotating arms and is forced onto the chain conveyor by the forward motion of the machine as it advances on its caterpillar treads. The conveyor chain and the caterpillar treads are driven by hydraulic motors.

The rotating arms can be retracted, the top cutter chain bar can be lowered and the bottom chain cutter bar can be raised, and this whole cutting head can be lowered and also tilted to give clearance for tramping. The rear end of the conveyor has both horizontal and vertical motion. These movements are all hydraulically controlled. There were six explosion-proof electrical parts on this machine: (1) A 100-horsepower motor driving the cutting elements; (2) a 50-horsepower motor driving hydraulic pump; (3) a contactor case; (4) 2 headlights; and (5) a conveyor light. Some of these accessories can be seen in figure 12, but some are obscured by other parts of the machine.

The 100-horsepower, fan-cooled motor driving the cutting element is at a, the contactor case is at b, 1 of the 2 headlights is at c. The contactor case is a ventilated design to remove corrosive compounds resulting from fixation of nitrogen by the electric arcs from the contactors. The explosion-proof breather for discharging the ventilating air can be seen at d.

The wiring between the various electrical units is protected from mechanical injury by hose conduits and by position. Appropriate overload devices are used to protect against excessive electrical overcurrents and short circuits.

Power is conducted to the machine through 500 feet or less of 4/0, 3-conductor, flame-resistant, portable cable. One conductor is used for a frame ground connection. The cable is protected by an instantaneous-trip circuit breaker set at 1,500 amperes. A ground-fault current trip is incorporated in the design of the protecting device. A mechanical cable strain clamp secured to the machine by a chain prevents strains on the terminal connection at the contactor case.

APPROVED MACHINES BUILT BY THE ENSIGN ELECTRIC & MANUFACTURING CO.

Bulletin 2025 Mining Machine

Approval 2-945A, covering the design of the Bulletin 2025 mining machine, was issued to the Ensign Electric & Manufacturing Co. on July 13, 1953. The approval applies to machines for operation from a 440-volt, alternating current supply.

Figure 13 shows a general view of a machine similar to the one originally approved. In operation, a planer or plow, a, while traveling in either direction

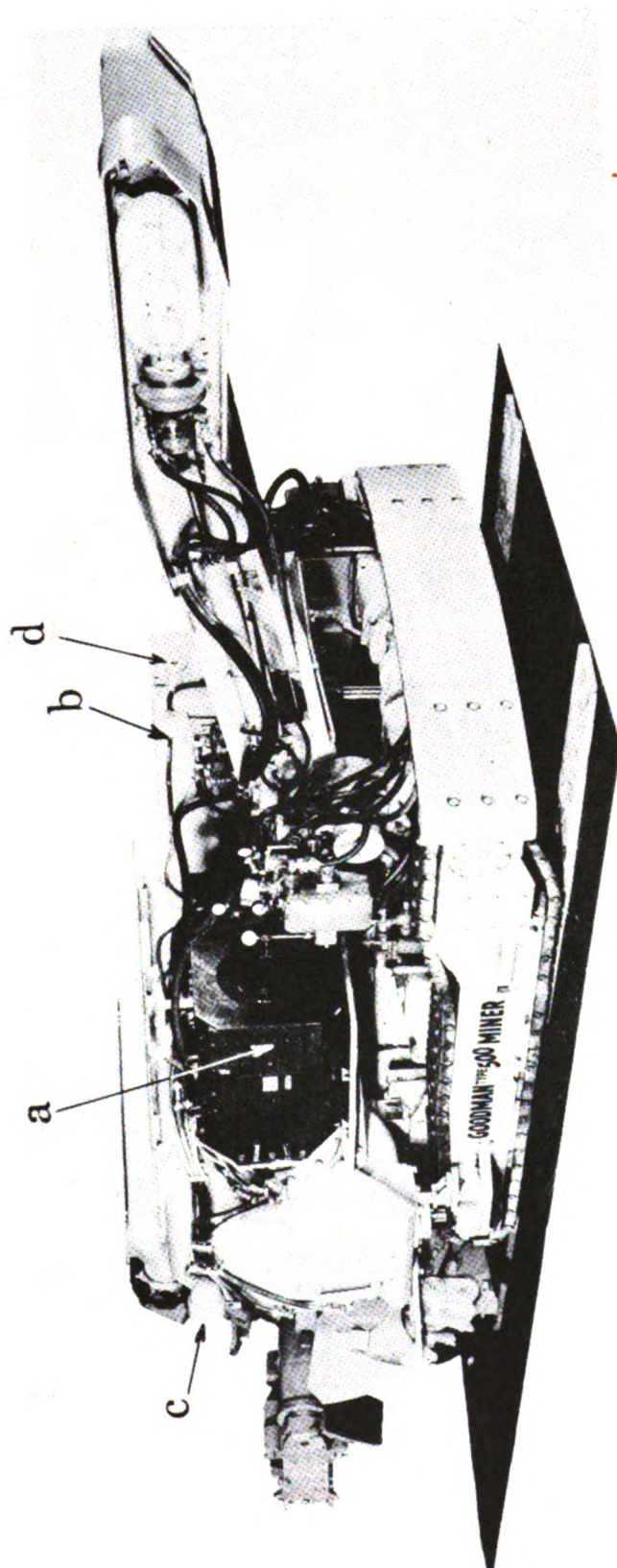


Figure 12. - Goodman type 500 miner.

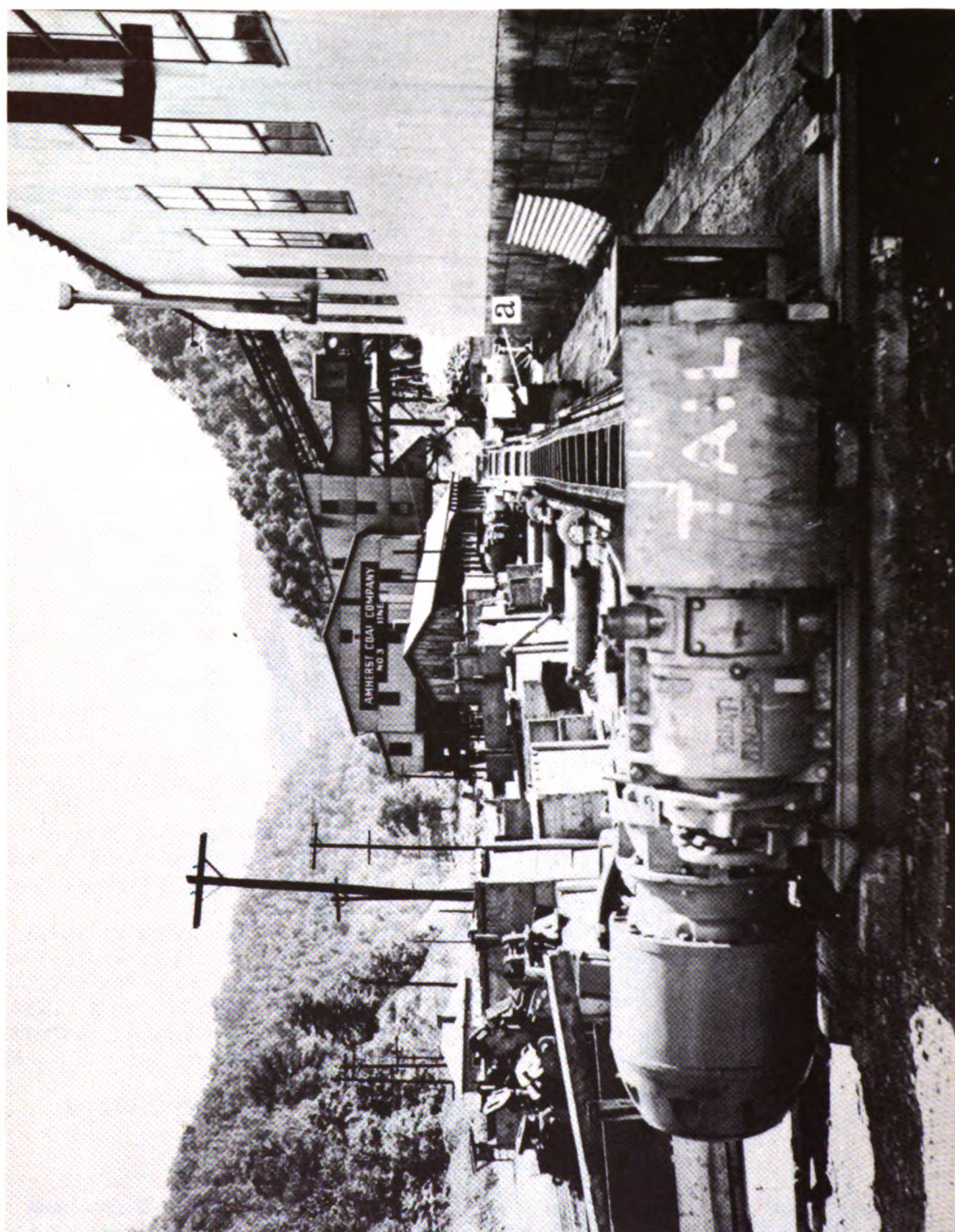


Figure 13. - Ensign bulletin 2025 mining machine.

mines coal from the solid face and plows it onto the conveyor. A detailed description of a comparable machine has been published in a Bureau of Mines publication.^{2/} The machine there described is of German manufacture. The electrical parts of the machine covered by the present approval are of American design and manufacture.

Thirty-seven parts in connection with this machine were required to be explosion-proof: (1) Three 50-horsepower motors; (2) 3 starters for 50-horsepower motors; (3) 2 limit switches; (4) 2 air valves; (5) 24 signal lights; (6) a master control case; (7) a 25-horsepower motor; and (8) a reversing starter. An explosion-proof meter case was added to the preceding parts by an extension of approval. Later, an auxiliary conveyor, including a 10-horsepower motor and a starter, was added by another extension of approval. Two connection boxes not required by the Bureau's schedule to be explosion-proof were explosion-proof also.

Power was conducted to the machine through 4 No. 2, 4-conductor and 1 No. 8, 4-conductor cables not over 500 feet long. Appropriate overload devices are used to protect the various circuits from excessive overcurrents. A circuit breaker, set at 150 amperes, is used at the outby end of each of the 3 large portable cables, and a circuit breaker set at 40 amperes is used at the outby end of the small portable cable.

An extension of approval was granted covering the design of a changed machine. The explosion-proof parts on this machine are the same as those listed for the original approval, except that four instead of three 50-horsepower motors and starters are used and the 25-horsepower motor and starter are eliminated.

^{2/} Haley, W. A., Dowd, J. J., and Turnbull, L. A., Modified Longwall Mining With a German Coal Planer (Plow) in the Pocahontas No. 4 Coal Bed, Helen, W. Va.: Bureau of Mines Rept. of Investigations 4922, 1952, 13 pp.